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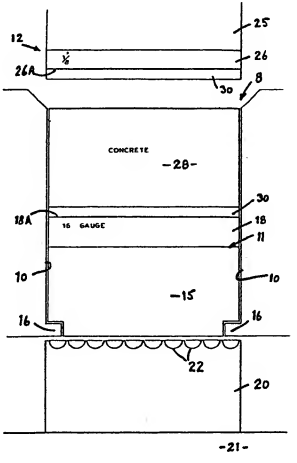
(71) Applicant
Natenco Automation & Robotics Limited (United Kingdom),
Quebec House, Quebec Street, Leeds LS1 2HA

(72) Inventor
Philip Martin Ashley

(74) Agent and/or Address for Service
Haseltine Lake & Co,
Hazlitt House, 28 Southampton Buildings, Chancery Lane, London WC2A 1AT

(54) Pressing products from water-solid mixtures

(57) A mould for pressing a mixture of compactable solid particles and water, such as wet concrete, has a movable platen (25) for compressing the mixture (28) to squeeze out water, and a perforate wall (18, 26) for allowing removal of water squeezed out. A filter layer of plastics or rubber material (30) lies between the perforate wall and the mixture. The filter layer is permeable, allowing water to pass through during compression of the mixture, and is resiliently compressible, so as to take up water when compression of the mixture ceases. The filter layer is re-usable.



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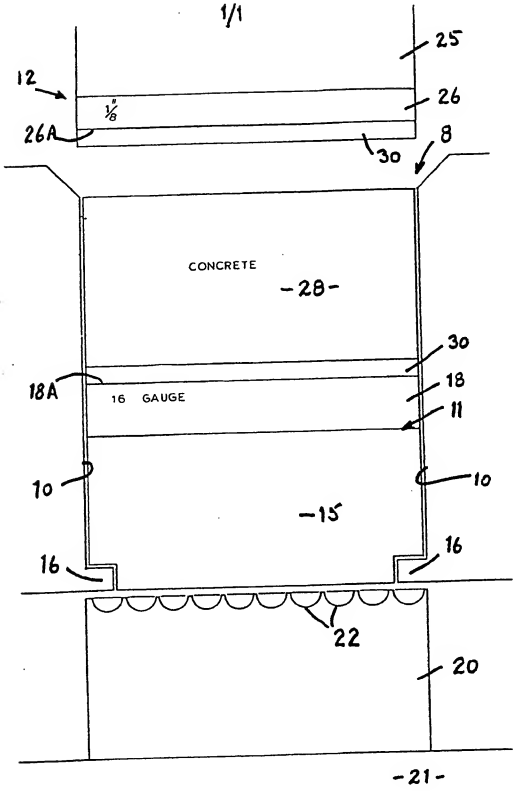
The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.



SPECIFICATION

Pressing products from water-solid mixtures

This invention relates to a method and apparatus for pressing products made from a mixture of solid particles and water. The invention is particularly, although not exclusively, applicable to the pressing of products made from wet concrete mix, the pressing serving to expel water and to compact the concrete, prior to drying.

In a method presently used for making concrete slabs, the pre-mixed (wet) concrete is fed into a mould chamber in a compacting press and the mix is then subjected to a compression force of around 400 tons. The mould chamber is formed by fixed, solid side walls of the mould table, a lower perforated sheet mounted on a former above a draining bed, and an upper perforated sheet which is attached to a die block carried by the press cylinder.

Both the upper and lower perforated sheets, referred to as platens, are rigid metal (steel) perforated plates and before the concrete mix is put into the mould chamber, prior to a pressing operation, a perforated paper sheet is placed on the lower platen at the bottom of the mould chamber; after the mould chamber is filled with mix, a further sheet of similar paper is placed on the top of the concrete mix.

The purpose of the paper sheets between the mould faces of the platens and the mix is essentially one of filtering, to allow the water to pass through yet retain the "fines" which make up the concrete product. The paper sheets also serve to absorb the final water traces.

After the pressing operation, the mould is opened and the product removed for drying, and the paper sheets are also removed from the compacted concrete (or from the platen faces). The paper sheets are not used again but are thrown away.

According to the present invention, there is provided a mould for pressing a mixture of compactable solid particles and water, the mould having at least one movable platen for compressing a wet mixture within the mould chamber, at least one wall of the mould being perforate for the removal of water passing through that wall from the mould interior, the moulding face of the perforate wall having on its surface a layer of re-usable permeable plastics or rubber material which is resiliently compressible and has a structure such that when it expands following compression it is capable of taking up and holding water.

The layer of plastics or rubber material is intended to be such a semi-permanent; that is, it will be used for very many pressing operations before it has to be discarded. For this reason, the permeable plastics or rubber layer may be bonded to the perforate mould wall by a suitable bonding process, though it would be possible to use the layer(s) loose.

To provide the compressibility and the ability to take up water, the plastics or rubber material conveniently has a porous structure, i.e. an open pore structure. The pore structure may be such that it has a capillary action with water. The plastics or rubber material has to be somewhat resilient because under the high pressures used, the layer will be compressed slightly and as the pressure is removed, after a pressing operation, the plastics or rubber layer expands to its unstressed thickness and in doing so absorbs the residual or final traces of water from the surface of the product. If such traces are not absorbed, they are likely to cause "run" marks, discolouration or other flaws in the product.

The open pore structure is preferably such that the material of the layer is permeable even when compressed as it is in that state that most of the water must pass through it. However, the permeability of the plastics or rubber layer can be increased by making small holes—needle holes—passing right through the layer, the size and number of the holes per unit area determining the permeability to suit particular operation requirements.

In use, the mould may be adapted so that suction can be applied behind the platen so as to enhance the withdrawal of water. In other embodiments removal of water under gravity may be adequate.

Where the layer is made of plastics material, a high-density plastics is preferably used in order to with stand the rather high pressures involved and to provide the good wear characteristics for extensive use even with abrasive mixes like concrete.

As a suitable material, it is proposed to use high-density polyethylene or a special polymer, for example high-density Alkathene.

The proposal according to the present invention of using a semi-permanent plastics or rubber filter layer avoids the need of having to insert and remove the paper sheets at each pressing operation, thereby making production more efficient; it also avoids the wastage and disposal problems associated with the consumption of large quantities of paper filter sheets.

Whilst the cost of the permeable plastics or rubber layer(s) will initially be greater than that of individual paper sheets, it is believed that with the very long life of the plastics or rubber layer material, a significant saving can nevertheless be achieved.

The invention may be put into practice in a number of ways but one specific embodiment will now be described, by way of example, with reference to the accompanying drawing which shows a mould in section.

The mould illustrated is for making rectan-

gular concrete slabs or blocks. It comprises a rectangular section mould chamber 8 formed of fixed solid side walls 10 afforded by the mould table, a bottom former assembly 11 which rests removably in the bottom of the mould chamber 8, and an upper die block assembly 12 which is movable vertically into or out of the mould chamber 8, as will be explained, to compress material in the mould chamber and to release a compacted product.

The bottom former assembly 11 is made up of a flat perforated former 15 with through-holes (not shown) distributed over its entire area, e.g. 3mm dia. at 25mm centres, which rests removably on shoulders 16 provided at the bottom of the mould table sides 10; and, resting on top of the former 15, a steel sheet or platen 18 perforated with holes to give a 40%—43% open area. Beneath this lower former assembly 11 is a draining bed 20 which rests on the press base 21, the upper face of which has grooves 22 for carrying away water which passes through the lower former assembly 11.

The upper die block assembly 12 is made up of a die block 25 which is mounted on a die carrier (not shown) carried by the press cylinder for movement up and down when the press is operated; and on the lower face of the die block 25 there is mounted a thick perforated steel sheet or platen 26. Vacuum extraction means, not shown, may be provided in the die block 25 for extracting water squeezed out from the moulded mixture through the perforate sheet or platen 26, though mechanical suction is not essential in all embodiments.

Covering each of the mould faces 18A, 26A of the lower and upper platens 18 and 26 is a layer of filter material 30 which allows water from a mixture being pressed to pass through but which does not allow the cementitious and aggregate particles to pass through, so that these solid particles are retained in the mould chamber 8 and compacted under the pressure applied between the platens 18 and 26 as the water is squeezed out.

The filter layers 30 are, in accordance with the invention, formed of a high-density plastics material which is strong and wear resistant, is resilient and has an open porous structure such that it is capable of absorbing water, for example by capillary action. Furthermore, the plastics layers 30 may be made more permeable by mechanically forming very small holes distributed over their surfaces, for example by means of needle punches.

A suitable plastics material for this purpose is a high-density polyethylene or a special polymer which is capillaried when produced so as to form the required porous and permeable structure. High-density Alkathene (made by Imperial Chemical Industries Limited, Group Chemicals Division) is one example of such a plastics material.

The permeable plastics layer 30 may be used simply in the form of loose sheets but since they are capable of being used repeatedly for very many pressing operations, it is envisaged that for ease of operation, the layers will be bonded to the respective platens 18 and 26 by some suitable bonding process, for example a suitable adhesive such as high strength epoxy adhesive, or using bonding tape.

The thickness of the plastics filter layers 30 will depend upon particular requirements and will be determined empirically for each case, (a typical thickness being 2mm relaxed). However, the layers 30 must be thick enough and resilient to enable the final traces of water to be removed at the end of a pressing operation. Thus, under pressure, the plastics layer will be compressed but when the compacting pressure is relieved, there will be a slight expansion owing to the resilience of the plastics material and this expansion causes the plastics material to draw in the residual water. It is believed that this effect is brought about either by a mechanical suction due to the pore expansion, or because the expansion allows the normal pore structure to take up the residual water by capillary action, or by a combination of both these effects.

In use of the mould, with the platens 18 and 26 both provided with the plastics layers 30, the mould chamber 8 is filled with the wet concrete mix 28 through the top of the mould with the upper platen 26 raised, and then the die block assembly 12 with the upper platen 26 is lowered into the mould chamber 8 by operating the press.

With the vacuum means (if provided) in operation, the press is operated to exert a compressive force of up to 400 tons, the pressure forcing the water out through the upper and lower plastics filter layers 30 and through the lower and upper platens 18 and 26. Pressure is applied in this way for a period of approximately 12 secs during which time 85% of the water will be removed leaving a moisture content of 5%. The water draining through the bottom former assembly 11 drains away under gravity via the draining bed 20.

The pressure is then relieved and in doing so the last traces of water at the surfaces of the product and platens will be taken up by and held in the plastics layers 30 as explained. The platen layers 30 will thus prevent any water passing back from the platens to the product surface. The mould is then opened by raising the die block assembly 12 with the upper platen 26, and the compacted product is removed for drying.

Since the material of the plastics (or rubber) layers 30 merely holds the water in the pores, its strength is not weakened when wet, unlike paper the wet strength of which is small.

Furthermore, the residual water in the filter layers from one compacting process is readily expressed when the layers are compressed in the next process; the resilience of the plastics or rubber material means that it can take up substantially the same amount of water each time it expands after being compressed. This is because the water is not absorbed into the matrix plastics (or rubber) material itself which is non-absorbent, but is simply held in the pores; with paper, the water is absorbed into the fibrous structure itself.

It will be appreciated that if a particular pattern is required to be pressed into the surfaces of the slab products, this can be arranged by pre-forming the plastics or rubber layers and/or the platens with an appropriate pattern.

Whilst the embodiment has been described above for producing concrete blocks, it is envisaged that the invention may be applicable to moulds for pressing other solid/liquid mixes. Also, the invention is not necessarily limited to the use of high-density polyethylene; it is conceivable that other porous plastics, such as special polymers, will be suitable or a suitable porous rubber material. It is conceivable that a low density plastics material might be suitable. It must be compressible and resilient so that it can take up and hold the residual water. For use in compacting concrete particularly, the filter material must be abrasion resistant.

CLAIMS

1. A mould for pressing a mixture of compactable solid particles and water or other liquid, the mould comprising at least one movable wall for compressing a mixture within the mould chamber, at least one wall of the mould being perforate to allow removal of liquid passing through that wall from the mould interior, and a permeable layer of plastics or rubber material which is resiliently compressible, adapted to be located between the mixture and the perforate wall.

2. A mould as claimed in claim 1, wherein the permeable layer has a structure such that when it expands following compression it is capable of taking up and holding water.

3. A mould as claimed in claim 1 or 2, wherein the permeable layer is bonded to the perforate wall.

4. A mould as claimed in claim 1 or claim 2, wherein the permeable layer is not secured to the perforate wall.

5. A mould as claimed in any one of claims to 4, wherein the permeable layer has a porous (open pore) structure.

6. A mould as claimed in claim 5, wherein the permeable layer exhibits a capillary action with water.

7. A mould as claimed in any preceding claim, wherein the permeable layer is permeable when compressed.

8. A mould as claimed in any preceding claim, wherein the permeable layer has a plurality of formed holes passing through the layer.

9. A mould as claimed in any preceding claim, further comprising suction means for applying suction to the perforate wall to remove liquid passing through that wall.

10. A mould as claimed in any preceding claim, wherein the permeable layer has relatively good wear resistant properties when repeatedly pressed with concrete mixes.

11. A mould as claimed in any preceding claim, wherein the permeable layer is made of a high-density plastics.

12. A mould as claimed in claim 11, wherein the permeable layer is made of a high density polymer.

13. A mould as claimed in claim 12, wherein the permeable layer is made of high density polyethylene.

14. A mould as claimed in claim 12 or claim 13, wherein the permeable layer is made of Alkathene.

15. A mould as claimed in any preceding claim, wherein the permeable layer is capable of withstanding a compressive load of up to 400 tons weight.

16. A mould as claimed in any preceding claim, wherein the permeable layer is preformed with a pattern, so as to impress the pattern into the surface of the mixture during compression.

17. A mould as claimed in any preceding claim, for pressing concrete products.

18. A method of pressing products made from a mixture of compactable solid particles and water or other liquid in a mould having at least one movable wall for compressing the mixture within the mould chamber, at least one wall of the mould being perforate to allow removal of the liquid passing through that wall from the mould interior, wherein before or after the mould chamber is filled with mixture to be pressed a re-usable permeable layer of plastics or rubber is located adjacent the perforate wall whereby during compression the liquid passes through the layer, the permeable layer having a structure which is resiliently compressible and which is capable of taking up and holding the liquid when it expands following compression such that after the pressing operation when the applied pressure is removed, the layer takes up any residual liquid from the product surface.

19. A filter for filtering water from a mixture of compactable solid particles and water, according to a method as claimed in claim 16, comprising a permeable layer of plastics or rubber material which is resiliently compressible and which has a structure such that on expansion following compression it is capable of taking up and holding water.

20. A filter as claimed in claim 19, wherein the permeable layer has a plurality of formed

hol s passing though the layer.

21. A filter as claimed in claim 19, or claim 20, wherein the permeable layer is permeable when compressed under a compressive load of up to 400 t ns weight.

22. A filter as claimed in any one of claims 19 to 21, wherein the permeable layer has an open pore structure and exhibits a capillary action with water.

23. A filter as claimed in any one of claims 19 to 22, wherein the permeable layer is made of a high density polyethylene, such as Alkathene.

24. A mould for pressing a mixture of compactable solid particles and water or other liquid, substantially as hereinbefore described with reference to the accompanying drawings.

25. A method of pressing a mixture of compactable solid particles and water or other liquid, substantially as hereinbefore described with reference to the accompanying drawings.

26. A filter for filtering water from a mixture of compactable solid particles and water, substantially as hereinbefore described with reference to the accompanying drawings.

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